A MODERN REVIEW OF THE DEMISE OF *HECATERA DYSODEA* D. & S.: THE SMALL RANUNCULUS

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Bolting and Varieties

Cultivated lettuce bolt, that is produce flower and seed, if the plants are subjected to adverse conditions of temperature or rainfall – usually too high and too little respectively – or are left for a long period when mature enough for human consumption. Should one of these meteorological conditions prevail during summer many more plants could be at a suitable stage of development for *dysodea* larvae. A study of the relevant weather records (Nicholas & Glasspoole, 1932; Meteorological Office, 1915; Manley, 1974) reveals that no such trend occurred.

Bolting lettuce would have been of more frequent occurrence a century ago compared to nowadays; widespread irrigation now partially offsets a long dry spell of weather, strains have been bred to extend the period before bolting takes place, and no doubt as the industry became more sophisticated and intensive due to foreign competition far fewer plants were allowed to come to flowering maturity. As it is bad commercial practise, more lettuce plants are allowed to run to seed in amateur gardens and allotments than in market gardens. Two thirds of the insect records come from areas of dense human population, as mapped in the 1930's (Philips, 1935) and, although there would have been more entomologists to note the species, this confirms that the small ranunculus fed primarily on *L. sativa*. Away from towns the moth was mostly concentrated in Essex and Cambridgeshire, both seed growing counties.

There have been numerous physically different varieties available since before the middle of the 19th century, at that time "very nearly twenty being enumerated as objects worthy of garden culture" (Rhind, 1860) and both Cos and Cabbage lettuce were mentioned; a few decades earlier thirty different varieties were reported (Phillips, 1822). More than a century later Watts (1954) listed 130 currently named British varieties, these being synonymous with a total of only 36 distinct physical varieties. At this time the varieties then available were stated to take between five and 28 days to bolt – the average being about two and a half weeks – and this was a slight improvement over the named varieties of half a century earlier; but this is probably misleading, as no doubt different strains within a variety were developed over the years for slow bolting characteris-

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tics. Clearly, a sudden and nationwide change from a variety which quick bolted to a considerably slower bolting one could have had a large detrimental effect on the moth. But, although public acceptance of new lettuce varieties can be swift, advances in breeding slow bolting strains were slow and concentration was probably on disease resistance.

For *dysodea* at Coggeshall, the cause of its decline was vexatiously reported as being that "the particular species of lettuce it mostly favoured is little cultivated there now and the moth is proportionately scarce" (Harwood, 1903) (the word "species" should have read "type" or "variety"). This is the only statement published at the time of the moths disappearance that attributed a definite cause for the decline – but it failed to name the type concerned. Important though this assertion is, it seems most unlikely that a lepidopterous larva which would feed on several different *species* of *Lactuca*, and even *Crepis*, would refuse a different *variety* of its favourite foodplant, to the point of extinction. Furthermore, I can find no lettuce variety in fashion over the last half of the 19th century that was not still being cultivated after the First World War. However, there was at one time much more Cos lettuce grown around the cities and it is probable that Harwood was referring to this decline in favour.

How the acreage of lettuce altered, taking into account the conflicting forces of foreign imports and the increasing number of local market-gardens, is unclear – but there is no doubt that large amounts of lettuce have been grown in the eastern counties from about the middle of the 19th century onwards. Equally certainly, the vegetable industry suffered continual encroachment by expanding towns and cities (London's population multiplied six times during the 19th century) which necessitated regular and locally complete removal of the gardens; this would have cost *dysodea* dear, as the moving would probably have been carried out during winter, for economic reasons, and those pupae which survived quick building would eventually yield moths that emerged to a local environment containing little or no suitable foodplant.

Climate

One possible indirect effect of climate on *dysodea* has already been mentioned and discounted; but there were a number of Lepidoptera, some widespread, which dramatically declined, eventually to extinction, over the last half of the 19th century – *A. crataegi, C. semiargus, C. arenaria, E. ilicifolia, A. pabulatricula, I. limbaria,* and *G. furcifera* (Bretherton, 1951). This suggests that a pervading detrimental influence such as climate was responsible; this has been positively linked to the decline of the black-veined white (Pratt, 1983) and to the increase of the white admiral (Pollard, 1979).

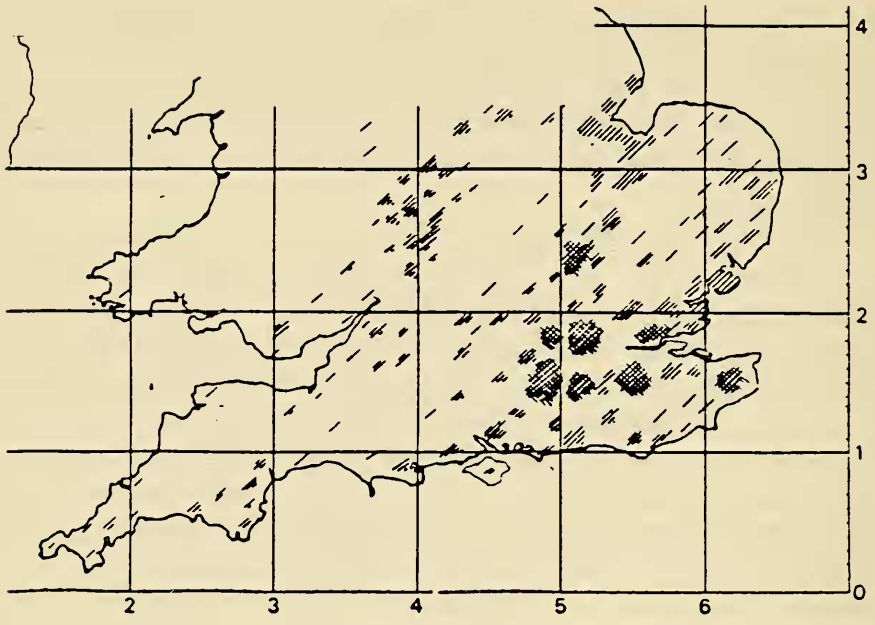

Figure 2. Frequency and distribution of *Hecatera dysodea* 1825 – 1900. *After* Heath (1979) with additions and corrections.

The small ranunculus moth was largely restricted to regions of relatively hot dry summers and its distribution is very similar to that published of annual rainfall below 30 inches (Meteorological Office, 1952). One of our most distinguished entomologists wrote that as regards Lepidoptera "in which a species always present is periodically common or scarce – much has been written, excessive *rain* being usually assigned as the cause of diminution in numbers, sunshine as the cause of increase. Without doubt these causes act to a very large extent" (Barrett, 1882). The period 1877 to 1883 inclusive was one of sequential wet summers (above average, June/July/August) but the following decades until well after the century's turn were of a drier regime (with some notable exceptions); there had been no comparable consecutive wet periods since those around 1830 and 1775 (Nicholas & Glasspoole, 1932). This six year sequence coincides well with the insects decline outside of its relatively dry eastern strongholds, where it was always less than frequent. Furthermore, there is some evidence that the moth suffered unusually badly during individual rainy summers. Although not unusual, from 1840 to 1915 there were 15 summer seasons during which rainfall exceeded 125% of average; of these, 12 coincided with times when no *dysodea* were reported or with the final year in a recorded cycle – there is also a lesser converse bias for dry seasons. These adverse conditions did not prevent the majority of species occuring commonly during some of these years (Beirne, 1947 A).

There was also a considerable increase in the amount of (wet) westerly winds over the first half of this century starting in 1896,

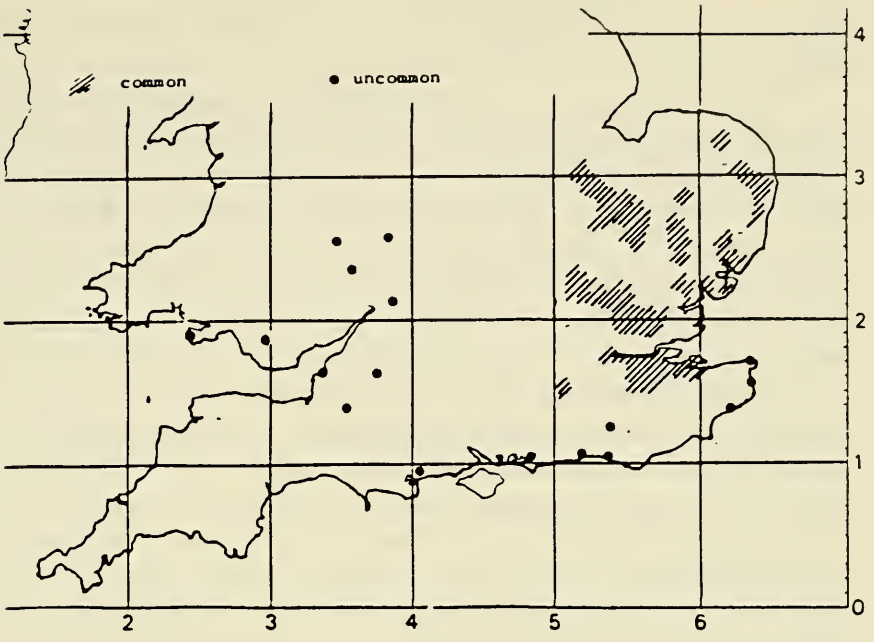

Figure 3. Diagrammatic quantitative distribution of commercially grown eating lettuce in 1958. *After* Coppock (1964).

dramatically increasing after 1902, and peaking in 1923 (Lamb, 1965) ; the coincidence is precise for the epilogue of *dysodea* but a study of the individual seasons records reveals no intimate relationship. Therefore, whilst there are some inconclusive indications that wet summers were of disadvantage to *dysodea*, fatally so in the south and west, there is less to suggest that they were a more serious factor in its eventual extinction in the drier east.

There was another climatic quirk at the end of the 19th century; from 1893 to 1939 there were 38 winters, many sequential, with above average temperatures (Manley, 1974) – the most pronounced period being 1910 to 1926 inclusive. This trend, of gradually increasing winter temperatures, whilst irregular at first became "very rapid after 1900" and the mean rise in these temperatures amounted to five degrees F., or more, in western and central Europe (Brooks, 1926). This temperature increase also coincides precisely with the main decline of the species in question. However, I have been unable to more intimately correlate this trend with the moth – although it would certainly have favoured avian predators – and as there was no coincidental decline of the insect elsewhere in Europe, where winter temperatures also rose, this mitigates against this climatic change being connected with this extinction.

Avian Predation

The increase in small birds has been mentioned in connection with the demise of *dysodea* (Bretherton, 1951). "As birds are amongst the most important of the natural enemies of the Lepi-

doptera their increase must have had important results" (Beirne, 1947).

With *Pieris* spp., the main predators on eggs, at least in Wiltshire, are the house sparrow and garden warbler; of larvae, the first mentioned, the tit family, and the song thrush (Baker, 1970). Sometimes larvae of *M. brassicae* L. are also cleared by birds (Anonymous, 1953) and cabbages would have often been grown in close proximity to lettuce. However, there is no evidence that *dysodea* faired better after the years when severe frosts caused heavy insectivorous bird mortality – but sparrows were much less affected by this weather (Gurney & Russell, 1885). The increase in sparrows took place over much of the 19th century with some concern being expressed, with a price on their heads, during the 1880's (Omerod, 1889). The increase followed that of human population and wheat production and both were often heavy in the areas favoured by the small ranunculus. Nevertheless, although avian predation on a gregarious larva such as *A. crataegi* was of crucial significance in its fight for survival, that on dispersed larvae would have been much less – especially when it "was much protected by its close resemblance to the flower-stems on which it rests by day" (Barrett, 1897).

The Wild Bird Protection Act around 1882, the zenith of the increase in sparrows at the same time, and the soon to arrive rise in winter temperatures (there were no severe winters from 1896 to 1916 inclusive) which would have been advantageous to other insectivorous birds, would all have increased avian predation over that period – but there is no evidence that they turned their attentions to the small ranunculus. Whilst no doubt many a *dysodea* larva filled a bird crop, there is no synchronous or other evidence that avian predators were a primary reason for this insects demise.

(to be concluded)

Notes and Observations

AN APPARENT PRONOUNCED SECOND GENERATION OF ECTROPIS CREPUSCULARIA (D. & S.) IN ESSEX IN 1984—Before 1983 there was no evidence to suggest that *Ectropis crepuscularia* occurred on Danbury Ridge in east-central Essex, save that the late Mr. H. C. Huggins found one at rest on Woodham Walter Common in late May, c. 1965.

E. bistortata (Goeze), on the other hand, is common. The first brood occurs from late March to early May; the second flies during July with a few persisting up to mid-August; and in some years there is a small third generation in October.

In this district the latter species has exhibited scarcely any variation in colour or markings: indeed, in the 18 years I have recorded here, during which period I must have examined many